may be the first incident of a bird holding an object and using it in a weapon-like fashion during an aggressive action against another bird. The incident reported herein adds to our understanding of how a variety of items in a bird's environment may be used to aid in pursuit of resources and to gain control over their living space.

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LITERATURE CITED

Boswell, J. 1983. Tool-using and related behaviour in birds: more notes. Avicultural Magazine 94–108.

Caffrey, C. 2001. Goal-directed use of objects by American Crows. Wilson Bulletin 13:114–115.

Chappell, J. and A. Kacelnik. 2002. Tool selectivity in a non-primate, the New Caledonian crow. Animal Cognition 5:71–78.

Chappell, J. and A. Kacelnik. 2004. Selection of tool diameter by New Caledonian crows (*Corvus moneduloides*). Animal Cognition 7:121–127.

Emory, N. J. 2006. Cognitive ornithology: the evolution of avian intelligence. Transactions of the Philosophical Society, Series B 361:23–43.

Emory, N. J. and N. S. Clayton. 2004a. Comparing the complex cognition of birds and primates. Pages 3–55 *in* Comparative vertebrate cognition: are primates superior to non-primates (L. J. Rogers and G. Kaplan, Editors). Kluvser Academic/Plenum, New York, USA.

Emory, N. J. and N. S. Clayton. 2004b. The mentality of crows: convergent evolution of intelligence in corvids and apes. Science 306:1903–1907.

Hansell, M. 1987. What's so special about using tools? New Scientist 1542:54–56.

Hunt, G. R. 1996. Manufacture and use of hook-tools by New Caledonian Crows. Nature 379:249–251.

Jones, T. B. and A. C. Kamil. 1973. Tool-making and tool using in the northern Blue Jay. Science 180: 1076–1078.

Lefebvre, L., N. Nicolakakis, and D. Boire. 2002. Tools and brains in birds. Behaviour 139:939–973.

Marzluff, J. M. and T. Angell. 2005. In the company of crows and ravens. Yale University Press, New Haven, Connecticut, USA.

McFarland, D. 1982. The Oxford companion to animal behavior. Oxford University Press, Oxford, United Kingdom.

Vauclair, J. 1997. Animal cognition: an introduction to modern comparative psychology. Harvard University Press, Cambridge, Massachusetts, USA.

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Turkey Vultures Use Anthropogenic Thermals to Extend Their Daily Activity Period

James T. Mandel[1,3] and Keith L. Bildstein[2]

ABSTRACT.—We describe predictable nocturnal soaring flight in Turkey Vultures (*Cathartes aura*) feeding at a landfill in eastern Pennsylvania. Birds feeding at the landfill returned to their roosts each evening by gaining altitude while soaring in thermals above flared methane vents at the site. Our results highlight behavioral plasticity in this species, which, in part, may explain why Turkey Vultures are so common throughout much of their extensive range. *Received 5 December 2005. Accepted 3 May 2006.*

Turkey Vultures (*Cathartes aura*) are energy minimizers like most avian scavengers (*sensu* Schoener 1971, Ruxton and Houston 2002). Individuals at rest maintain low metabolic rates for their body mass and reduce their core body temperature at night in apparent efforts to conserve energy (Heath 1962, Wasser 1986). Turkey Vultures in flight usually soar and glide when flying between roosts and previously located food, when searching

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for new sources of food, and during migration (Pennycuick 1972, Mundy et al. 1992, Kirk and Mossman 1998, Ferland-Raymond et al. 2005). At times, the species engages in intermittent flapping flight, particularly when departing from and descending into their roosts. This behavior is generally rare except when updrafts are unpredictable or weak. Our observations, assisted by radio tracking, indicate that lack of sufficient assisted lift can ground individuals several days or more (JTM, pers. obs.). Turkey Vultures have long been known as "late risers" (Ludlow Griscom *in* Bent 1937) that usually restrict their daily activities to mid morning to late afternoon when thermal- and slope-soaring are possible (Kirk and Mossman 1998).

Anecdotal and possibly disturbance-induced nocturnal flight has been reported in the species (Tabor and McAllister 1988) but regular nocturnal flight is unknown. Here, we report regular nocturnal flight in Turkey Vultures returning to their roosts in the evening after soaring in anthropogenic thermals created by flared methane at a landfill in eastern Pennsylvania.

METHODS

We watched Turkey Vultures on 120 nonrainy days from 12 July to 5 November 2004, and from 20 June to 17 July 2005, at a 45-ha Waste Management, Inc. landfill in Pen Argyl, Northampton County, Pennsylvania (40° 52′ N, 75° 15′ W). Birds were observed continually from 0730 to 2315 hrs EST, with a 3-hr break from 1300 to 1600 hrs EST. Observations were from an unused hilltop on landfill property, with the farthest roost being ~300 m. Adequate artificial lighting at the site permitted nocturnal observation without special equipment. Prior to the observations detailed here, we observed vultures at three communal roosts near the landfill for 20 days in June 2004 and for 47 days in July and August 2003. Our roost-site observations, which were conducted from dawn until dusk, and included both unmarked individuals and radio-marked birds, are used here to establish a temporal baseline for vulture behavior in the area.

Methane is vented at two sites at the landfill. One site, the "big flare," consists of a group of three 10-m-high vent pipes. The other site, the "little flare," consists of a single 10-m vent pipe. At both sites methane is flared continuously, around-the-clock, 365 days a year.

OBSERVATIONS

Between 30 and 90 Turkey Vultures fed at the landfill daily. On more than 70% of the days, 10 to 15 individuals fed until 2100 to 2300 hrs EST or approximately 90 to 210 min after local sunset. We do not know whether the late-feeding birds were the same individuals each day, or whether a larger subset of the population engaged in late feeding on an occasional basis. Vultures that fed in farmlands, woodlands, and suburban areas near the landfill returned to their roosts before 2000 hrs EST or, at most, 30 min after the local sunset.

Turkey Vultures that left the landfill used both natural thermals and anthropogenic thermals at the methane vents throughout the day to gain lift before departing the site. When natural thermals were no longer available after sunset, vultures that left the landfill initially approached the vents in flapping flight, and then circle-soared to approximately 100–200 m in thermals above the vents before gliding in the direction of nearby roosts. On most days, 10 to 30 vultures arrived at the landfill before 0800 hrs EST, soared above the vents for several minutes, and then departed, presumably for more distant feeding sites.

Turkey Vultures feeding at the site roosted in three communal roosts within 4 km of the landfill. Two of the roosts contained 30–50 Turkey Vultures and 5–10 Black Vultures (*Coragyps atratus*). A third roost contained 10–15 Turkey Vultures. Black Vultures at times fed at the landfill but none remained as late in the day as Turkey Vultures, and none soared in thermals above the vents.

DISCUSSION

Thermals created by flared methane appeared to be considerably stronger and hotter than nearby "natural" thermals. Vultures soaring above the vents ascended more rapidly than those soaring in nearby natural thermals, and many appeared to have difficulty maintaining level flight while doing so. Most of the birds that flew within vent thermals did so intermittently, and rather than circle-soaring radially about the center of the thermal while ascending constantly, circle-soared tan-

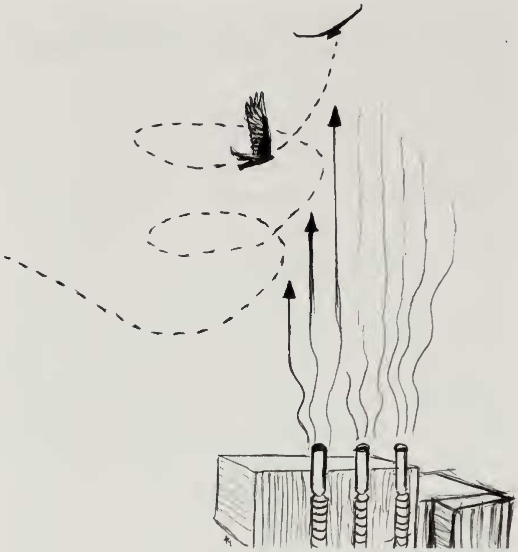

FIG. 1. The "big flare," the main methane vent facility at the Waste Management, Inc. landfill in Pen Argyl, Pennsylvania. Vultures soaring with the thermal created by the flared methane at the vents do so tangentially, rather than radially.

gentially within the thermal for brief periods and then circle-glided outside the thermal for longer periods (Fig. 1). We believe that individuals did so because they were not able to soar continually within the vents. Workers at the site reported finding Turkey Vulture carcasses at and near the bases of the vents, suggesting that in addition to providing soaring opportunities for vultures, the anthropogenic thermals at the vents also killed them, most likely either by scorching or suffocating individuals. Thus, the vents may have created an "ecological trap" for the birds that used them (Schlaepfer et al. 2002).

That Turkey Vultures, but not Black Vultures, soar in vent thermals at this site may be due several factors. First, many vultures that roosted nearby searched for carrion in the surrounding landscape rather than for food refuse at the landfill, suggesting that food was limited at the landfill. We tested this hypothesis by placing a road-killed white-tailed deer (*Odocoileus virginianus*), a road-killed common raccoon (*Procyon lotor*), and a butchered chicken (*Gallus domesticus*) at visible locations at the site to examine the extent of competition for food. Up to six Black and Turkey vultures fed upon the chicken simultaneously, and up to 14 individuals fed simultaneously upon the deer. Black Vultures dominated Turkey Vultures at feeding sites, suggesting the former may be able consume sufficient food without prolonging the length of their feeding day. Second, Turkey Vultures typically hold their wings in a pronounced dihedral when flying low over the landscape, a self-righting aerodynamic "design" that stabilizes their flight in turbulent air (Mueller 1972), whereas Black Vultures do not. The relatively turbulent nature of thermals above the vents may have precluded their use by Black Vultures.

That Turkey Vultures are able to lengthen their daily activity periods via use of anthropogenic thermals suggests considerable behavioral flexibility in the species. This may help explain its large range and relative abundance.

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LITERATURE CITED

BENT, A. C. 1937. Life histories of North American birds of prey. Part 1. U.S. National Museum Bulletin 167.

FERLAND-RAYMOND, B., M. BACHAND, D. THOMAS, AND K. BILDSTEIN. 2005. Flapping rates of migrating and foraging Turkey Vultures (*Cathartes aura*) in Costa Rica. Vulture News 53:1–5.

HEATH, J. E. 1962. Temperature fluctuations in the Turkey Vulture. Condor 64:234–235.

KIRK, D. A. AND M. J. MOSSMAN. 1998. Turkey Vulture (*Cathartes aura*). The birds of North America. Number 339.

MUELLER, H. C. 1972. Zone-tailed Hawk and Turkey Vulture: mimicry or aerodynamics? Condor 74: 221–222.

MUNDY, P., D. BUTCHART, J. LEDGER, AND S. PIPER. 1992. The vultures of Africa. Academic Press, London, United Kingdom.

PENNYCUICK, C. J. 1972. Soaring behaviour and performance of some East African birds, observed from a motor glider. Ibis 114:178–218.

RUXTON, G. D. AND D. C. HOUSTON. 2002. Modelling the energy budget of a colonial bird of prey, the Ruppell's Griffon Vulture, and consequences for its breeding ecology. African Journal of Ecology 40:260–266.

SCHLAEPFER, M. A., M. C. RUNGE, AND P. W. SHERMAN. 2002. Ecological and evolutionary traps. Trends in Ecology and Evolution 17:474–480.

SCHOENER, T. W. 1971. Theory of feeding strategies. Annual Review of Ecology and Systematics 2: 369–404.

TABOR, S. P. AND C. T. MCALLISTER. 1988. Nocturnal flight by Turkey Vultures (*Cathartes aura*) in south-central Texas. Journal of Raptor Research 22:91.

WASSER, J. S. 1986. The relationship of energetics of falconiform birds to body mass and climate. Condor 88:57–62.

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Mallards Feeding on Salmon Carcasses in Alaska

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ABSTRACT.—Mallards (*Anas platyrhynchos*) are known to frequent rivers and streams during post-breeding. I describe observations of Mallards feeding on fresh Pacific salmon (*Onchorhynchus* spp.) carcasses in Alaska on two separate occasions during July–August 2005. These observations represent the first reported use of salmon carcasses by Mallards in Alaska. This strategy may be fairly common for a segment of post-breeding and fall staging Pacific Flyway Mallards in Alaska, particularly those that inhabit streams and rivers used by the five species of Pacific salmon during the spawning season. *Received 19 December 2005. Accepted 29 July 2006.*

The Mallard (*Anas platyrhynchos*), a ubiquitous dabbling duck distributed across North America, is a generalist omnivore. Diets of dabbling ducks vary geographically and seasonally, with animal (primarily invertebrates) and plant matter (natural wetland plants and agricultural crops) comprising the bulk of diets in spring/summer and fall/winter (Bellrose 1980, Baldassarre and Bolen 1994). Importance of salmon (*Onchorhynchus* spp.) as nutrients to aquatic and terrestrial habitats is well documented (Cederholm et al. 1999, Hilderbrand et al. 1999, Gende et al. 2002, Reimchen et al. 2003, Gende et al. 2004, Hilderbrand et al. 2004). This has led some researchers to consider that salmon are keystone species (Willson and Halupka 1995). A wide variety of vertebrates, including birds and mammals, consume anadromous salmon as predators of live fish or as scavengers of carcasses. A diverse assemblage of birds (including the Mallard) has been identified as consuming salmon eggs or juvenile offspring (i.e., alevin or parr) (Cederholm et al. 1989, table 7; Willson and Halupka 1995, table 1). In this paper, I report the consumption of salmon muscle tissue and internal organs by Mallards.

OBSERVATIONS

On 16 July 2005 while fishing on the Kenai River near Soldotna, Alaska (150° 58′ W, 60° 28′ N), I observed (1100 hrs AST) an adult female Mallard and five ducklings (Class III, Gollop and Marshall 1954) tipping-up and removing flesh from sockeye salmon (*Onchorhynchus nerka*) carcasses discarded after being filleted by anglers. The female with her brood proceeded upstream between the anglers and the riverbank, periodically tipping-up to dabble on carcasses. I witnessed 4–5 separate feeding attempts over ~15 min before the female and brood left my field of view.

On 13 August 2005 while fishing at Sheep Creek Slough near Willow, Alaska (150° 05′ W, 61° 58′ N), I observed (1000 hrs AST) a single adult male Mallard feeding on coho salmon (*Onchorhynchus kisutch*). The Mallard was surface dabbling and feeding with neck submerged. I observed the Mallard ingest a sperm sac and several relatively small fragments of muscle tissue carried downstream from a fish cleaning station. During observations at both locations, I was sufficiently close (<3 m) to the Mallards to observe ingested items pass the esophagus.

DISCUSSION

Mallards have been known to feed on perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), dace (*Leusciscus vulgaris*), and three-spine stickle-

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